Manufacturing productivity and labor costs in 14 economies

Over the 1960–90 period, the U.S. and Canada had smaller average annual increases in labor productivity than did Japan or the nine European countries studied, but long-term trends in unit labor costs have been favorable for U.S. trade competitiveness

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Labor productivity, as measured by output per hour, rose 2.5 percent in U.S. manufacturing in 1990. Compared with the rates of 11 other industrial nations studied—Canada, Japan, and 9 Western European countries—this figure falls in the middle of the range of productivity growth.

Since 1960, the United States and Canada have had the smallest average annual increases in productivity. Between 1973 and 1979, all 12 economies experienced productivity growth-rate slowdowns. Since 1979, however, the U.S. productivity growth rate has nearly matched the rate of gain prior to 1973. The United Kingdom is the only other country to record a significant improvement since 1979; all of the other countries except Norway have seen their productivity growth rates slow even more.

Unit labor costs, which reflect changes in labor productivity and hourly compensation costs, have a direct effect on the price of manufactured goods and, therefore, affect the competitiveness of a country's products in world trade. A smaller increase (or a decrease) in unit labor costs, relative to other countries, should, ceteris paribus, improve a country's price competitiveness. In 1990, unit labor costs rose less than 1 percent in the United States. This was the smallest increase among all the economies studied, which include those of Korea and Taiwan, in addition to the 11 foreign countries referred to above. The United States also has had the smallest average annual increases since 1960, but Japan, Belgium, and the Netherlands have had even lower average increases since 1979.

On the one hand, the relatively small 1990 increase in U.S. unit labor costs acted to improve the competitive position of U.S. manufacturing. U.S. competitiveness was given a further substantial boost relative to the European countries by exchange rate movements over the course of the year. On the other hand, the U.S. dollar rose relative to the Asian currencies, and unit labor costs, adjusted for exchange rate changes, fell in Japan and Korea.

Exchange rate movements have had substantial effects on relative changes in unit labor costs since the early 1970's. Relative to a trade-weighted average for the other 13 economies, the value of the U.S. dollar fell 6 percent between 1973 and 1979, rose 44 percent between 1979 and 1985, and subsequently fell 34 percent between 1985 and 1990, for an overall decline of 10 percent since 1973.

U.S. relative unit labor costs, measured on a U.S. dollar basis, fell 15 percent between 1973

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and 1978–79, rose 37 percent between 1979 and 1985, and fell 42 percent between 1985 and 1990. As of 1990, U.S. relative unit labor costs were down 32 percent from 1973.

This article examines comparative trends in manufacturing output per hour, unit labor costs, and related measures for the United States and 11 other industrial nations in 1990, and, subsequently, over the 1960–90 period, with discussions of selected subperiods. Data for Germany relate to the former West Germany. (For a description of the country measures, see the appendix at the end of the article.)

Also in this article are trends in unit labor costs in Korea and Taiwan since 1973. The Bureau has not computed productivity measures for Korea and Taiwan, because adequate labor input measures, for use with the output measures, have not been developed. They are included in the analysis of comparative developments in unit labor costs, however, because only Canada, Japan, and Germany currently account for higher proportions of U.S. direct trade in manufactured goods.

Finally, the analysis includes relative trade-weighted measures of productivity and unit labor costs, that is, the U.S. measure relative to a trade-weighted average for the other economies or selected economies.

Data revisions

In addition to the usual modifications of recent yearly figures, the measures included in this article reflect major revisions of the U.S., Japanese, and German national accounts. The Italian national accounts underwent a less sweeping revision.

The U.S. manufacturing productivity figures are based on the national accounts measure of gross product originating in manufacturing compiled by the U.S. Department of Commerce, Bureau of Economic Analysis. In 1988 and 1989, a number of analysts questioned the accuracy of this measure, suggesting that real growth in manufacturing output since 1973, and particularly since 1979, may have been less than suggested by the published measures.[1] These criticisms led the Bureau of Economic Analysis to suspend publication of the gross product originating numbers in 1989 and provided the impetus for an extensive review of the data. In January 1991, the Bureau of Economic Analysis published revised manufacturing output figures for the 1977–87 period and new estimates for 1988.[2] In May 1991, it published data for 1989, as well as revisions to the 1988 figures. Further work to improve the pre-1977 gross product originating measures is planned. Currently, the previous series has been linked to the new series at 1977.

The U.S. manufacturing output revisions caused changes in levels and growth rates on a year-to-year basis, but had little effect on the long-term trend measures.

The Bureau of Economic Analysis has scheduled a major revision of the U.S. national accounts for December 1991, including a change in the price-base year from 1982 to 1987. However, this revision will not include the gross product originating numbers by industry; they will be revised during 1992. Consequently, the figures used in this article are based on 1982 price weights, and the 1990 manufacturing output figure is based on the trend shown by the industrial production indexes published by the Federal Reserve Board.

The Japanese revisions involve a shift of the base period from 1980 to 1985 for constant price output and a recalculation of the output measures back to 1970 based on 1985 price weights. Employment and compensation were revised from 1981 forward. The German constant price output measures were rebased to 1985, and the historical figures were recalculated on the new price base back to 1960. Compensation was revised back to 1971. The Italian constant price measures were rebased to 1985 for the period 1980 forward.

Comparative trends, 1989–90

Productivity. U.S. manufacturing labor productivity rose 2.5 percent in 1990. Japan, Belgium, Germany, and Italy had more rapid productivity growth, in the range of 3-5 percent; Denmark and Norway about matched the U.S. rate of increase; and Canada, France, the Netherlands, Sweden,[3] and the United Kingdom all experienced slower productivity growth. (See table 1.)

U.S. productivity performance in 1990 represents an improvement over the previous year, when productivity grew at a rate of 1 percent—the smallest increase of the 1980's. However, this productivity improvement occurred in the context of a reduction in output growth and declines in employment and hours worked.

In contrast, the productivity increases recorded by Japan, Germany, and the Netherlands were accompanied by increases in employment of 2 to 3 percent. France's productivity increase was only 1 percent, but it was the only other country in which labor input rose. Employment fell in Belgium, but total hours were about unchanged.

In addition to the United States, three other countries —Denmark, Italy, and Norway—had

productivity gains that resulted from a combination of small increases in output and falling hours worked. In spite of output declines, Canada, Sweden, and the United Kingdom also recorded productivity gains in 1990 because hours worked dropped even more.

Output and labor input. U.S. manufacturing output grew only about 1/2 of 1 percent in 1990—the second consecutive year in which there was a significant dropoff in output growth and the lowest U.S. output growth since the recession year of 1982. The U.S. growth rate was exceeded by 8 of the 13 foreign economies studied. Korea led the group with an 8-1/2 percent rate of gain followed by Japan, Belgium, Germany, and the Netherlands, which recorded increases between 4 and 5 percent. On the oppo-

Table 1. **Annual percent changes in manufacturing productivity, unit labor costs, and related measures, 14 countries or areas, selected periods, 1988–90**

Country or area	Output per hour	Output	Total hours	Employment	Hourly compensation	Unit labor costs		Exchange rate
						National currency	U.S. dollars	
United States								
1988–89	0.9	1.3	0.4	0.5	3.9	3.0	3.0	—
1989–90	2.5	.4	–2.0	–1.5	3.2	.7	.7	—
Canada								
1988–89	.5	.3	–.2	.9	6.4	5.9	10.0	3.9
1989–90	1.3	–5.3	–6.6	–5.4	7.0	5.6	7.2	1.5
Japan								
1988–89	5.2	6.4	1.2	2.4	6.0	.8	–6.4	–7.2
1989–90	3.6	4.4	.7	2.4	5.2	1.5	–3.4	–4.8
Korea								
1988–89	(1)	3. 7	(1)	(1)	(1)	15.7	26.0	8.9
1989–90	(1)	8.4	(1)	(1)	(1)	4.3	–1.0	–5.1
Taiwan								
1988–89	(1)	3.7	(1)	(1)	(1)	4.4	13.3	8.4
1989–90	(1)	–.2	(1)	(1)	(1)	4.5	2.5	–1.9
Belgium								
1988–89	4.0	5.6	1.6	2.1	5.3	1.2	–5.5	–6.7
1989–90	4.1	4.2	.1	–1.1	6.6	2.4	20.7	17.9
Denmark								
1988–89	2.7	1.2	–1.4	–.2	5.0	2.2	–5.9	–7.9
1989–90	2.3	1.5	–.8	.3	5.1	2.7	21.5	18.3
France								
1988–89	4.8	4.5	–.2	.3	4.1	–.6	–7.2	–6.6
1989–90	1.1	1.7	.7	.9	3.9	2.8	20.5	17.1
Germany								
1988–89	4.6	4.8	.1	1.4	4.8	.2	–6.4	–6.6
1989–90	4.5	5.1	.6	2.9	6.9	2.3	19.1	16.3
Italy								
1988–89	3.1	3.4	.3	.5	9.4	6.2	.8	–5.1
1989–90	3.2	1.1	–2.0	.5	10.9	7.5	23.1	14.5
Netherlands								
1988–89	2.9	4.5	1.6	1.8	1.0	–1.8	–8.5	–6.8
1989–90	1.9	4.0	2.0	2.0	3.2	1.3	18.0	16.5
Norway								
1988–89	3.7	–2.7	–6.2	–6.8	4.2	.5	–5.2	–5.6
1989–90	2.3	.2	–2.0	–2.0	5.9	3.5	14.4	10.5
Sweden								
1988–89	.3	1.2	.9	–2.5	9.1	8.8	3.4	–4.9
1989–90	.5	–2.8	–3.3	–3.0	9.2	8.7	18.4	9.0
United Kingdom								
1988–89	4.8	4.2	–.6	.0	9.5	4.5	–3.9	–8.0
1989–90	.9	–.5	–1.3	–1.0	11.7	10.7	20.6	8.9

[1] Not available.

site end of the spectrum, several countries experienced sharp declines in output over the year. Canadian output declined more than 5 percent, and Swedish output fell about 3 percent. The United Kingdom recorded a more modest decline of 1/2 of 1 percent. Output was virtually unchanged in Taiwan and Norway.

Manufacturing employment fell in 1990 in 6 of the 12 countries for which this measure was calculated.[4] U.S. employment fell 1-1/2 percent, a rate of decline that was exceeded by Canada's drop of 5-1/2 percent and declines of 2-3 percent in Norway and Sweden. By contrast, employment increased nearly 3 percent in Germany in 1990, the strongest employment growth among the countries studied and the most rapid rate of increase seen in that country in 21 years. Employment was also up strongly in Japan for the third consecutive year and in the Netherlands, which has had 6 years of constant employment growth. France experienced its second consecutive year of employment growth following 14 consecutive years of decline. With the exception of Belgium, total hours worked in manufacturing fell in the countries that experienced employment declines, as well as in Denmark and Italy.

Hourly compensation costs. Hourly compensation costs—which comprise wages and salaries, supplements, and employer payments for Social Security and other employer-financed benefit plans—rose a little over 3 percent in U.S. manufacturing in 1990. This rate of increase was matched by that of the Netherlands, but was lower than the increases in any of the 11 other industrial countries covered. Canada, Japan, Belgium, Denmark, France, Germany, and Norway had hourly compensation increases between 4 and 7 percent; Italy, Sweden, and the United Kingdom recorded rises between 9 and 12 percent.

Unit labor costs. The 1989–90 increase in U.S. manufacturing unit labor costs was less than 1 percent. Japan and the Netherlands were closest to the United States, with increases of about 1-1/2 percent. On the opposite end of the spectrum, Italy, Sweden, and the United Kingdom—the countries with the largest gains in hourly compensation costs—had increases between 7 and 11 percent.

Unit labor costs in U.S. dollar terms. In addition to having the smallest increase in manufacturing unit labor costs measured in national currency terms, the U.S. competitive situation was greatly improved—relative to the European economies—by exchange rate changes. Between 1989 and 1990, European annual average currency values, relative to the U.S. dollar, appreciated from 9 percent in Sweden and the United Kingdom up to about 18 percent in Belgium and Denmark. Therefore, the relative improvement in U.S. unit labor costs, measured in national currency terms, was greatly enhanced, with respect to the European economies studied, by exchange rate movements. Measured in U.S. dollar terms, European unit labor costs rose 14 to 23 percent. In 1989, most of the European countries had unit labor cost declines, measured in U.S. dollars, because all of their currencies depreciated. However, the 1988–89 depreciations were generally far smaller than the 1989–90 appreciations, and U.S. competitiveness, as measured by unit labor costs, improved strongly over the 2-year period.

The Canadian dollar also appreciated in 1990, for the fourth consecutive year, but by only 1-1/2 percent.

In contrast to the Canadian and European currencies, the Japanese yen fell 5 percent between 1989 and 1990 relative to the U.S. dollar, following a 7-percent decline in the previous year. Consequently, Japanese unit labor costs, which rose very little in either year, measured in yen, fell 3-1/2 percent in 1990, measured in U.S. dollars, on top of a 6-1/2 percent decline in 1989.

The currency of Korea fell by 5 percent in 1990, and that of Taiwan fell 2 percent. Unit labor costs, in U.S. dollars, fell 1 percent in Korea, but still rose 2-1/2 percent in Taiwan.

Recent exchange rate changes. As of October 1991, the Japanese yen was up 11 percent relative to its 1990 average value, the Canadian dollar was up 3-1/2 percent, and the Taiwanese dollar was up nearly 2 percent. European currency values and the value of the Korean won were down 3 percent to 6 percent.

European exchange rates were volatile through the first 10 months of 1991, however, as was the Japanese yen. All of the European currencies appreciated vis-a-vis the U.S. dollar in January and February 1991, declined from March to July, and then recovered partially from August to October. The yen also peaked in February, declined between February and June, and then rose again between June and October. The Canadian dollar appreciated moderately throughout most of the year, the Korean won depreciated throughout the year, and the Taiwanese dollar depreciated through April and then appreciated.

In the first three quarters of 1991, U.S. unit labor costs were up nearly 3 percent over the first three quarters of 1990. The 1991 changes

in relative exchange values, therefore, suggest that U.S. manufacturing competitiveness may have improved somewhat relative to Japan, but probably not relative to the European countries.

Comparative trends, 1960–90

Productivity. Over the three decades since 1960, U.S. manufacturing productivity has risen at an average annual rate of about 3 percent per year. This long-term performance was exceeded by all the other countries studied except Canada, whose average productivity growth rate matched that of the United States. (See table 2.) Productivity growth in the nine European countries studied ranged from nearly 3-1/2 percent to 6 percent per year over the period, while Japan experienced average productivity growth of 7 percent.

As in previous analyses of this subject, the Bureau of Labor Statistics divides the time period since 1960 into the years preceding 1973 and those subsequent to 1973.[5] U.S. output peaked in 1973, and the years since 1973 have been characterized by a slowdown in the productivity growth rate. The U.S. rate slowed from 3.3 percent per year between 1960 and 1973 to 2.5 percent per year between 1973 and 1990. The year 1973 is also a useful breaking point for productivity comparisons—manufacturing output generally peaked in 1973 or 1974 in the foreign economies studied, and all have experienced productivity growth rate slowdowns in the latter period. With the exception of the United Kingdom, the productivity slowdowns in the foreign countries studied have been more substantial than in the United States, although from larger pre-1973 rates of gain.

It is also useful to divide the 1973–90 period at 1979, which was another peak output year for the United States. In addition, U.S. manufacturing productivity growth accelerated from about 1-1/2 percent per year between 1973 and 1979 to 3 percent per year between 1979 and 1990. The year 1979 has also been used as a breaking point for the foreign economies studied, because output generally peaked in 1979 or 1980. The notable exception to this pattern is Japan, which did not experience a drop in output until 1986.

Average productivity growth rates for the periods 1960–73, 1973–79, and 1979–90 are shown in chart 1 for the United States, Canada, Japan, Europe (trade-weighted average), and selected European countries.

Between 1979 and 1990, British productivity rose about 4-1/2 percent per year, greatly exceeding the average rate of gain between 1973 and 1979 and also exceeding the pre-1973 rate of increase. The United States is the only other country covered by this study whose average productivity growth rate between 1979 and 1990 was nearly equal to its pre-1973 rate of gain. In addition, the United States was the only other country to experience a substantial productivity growth rate increase in the 1979 to 1990 period, compared with the 1973 to 1979 period. Norway recorded a modest increase; the other countries studied experienced further slowdowns. Even so, U.S. productivity growth between 1979 and 1990 was matched by France and the Netherlands and exceeded by Japan, Belgium, and Italy, as well as the United Kingdom. However, the U.S. rate exceeded the average rates recorded by Canada, Denmark, Germany, Norway, and Sweden of under 2-1/2 percent.[6]

Output. Long-term U.S. manufacturing output growth has averaged 3.3 percent per year over the 1960 to 1990 period. Six of the eleven foreign economies for which data are available back to 1960 exceeded this average rate; Denmark, Germany, and Sweden had similar rates of increase; Norway and the United Kingdom had smaller average increases.

All countries studied experienced substantial slowdowns in output growth after 1973. As is true for productivity, the foreign countries' output slowdowns were generally more significant than that of the United States, although most started from larger pre-1973 rates of gain. Two countries had particularly small overall output gains in the post-1973 period—Norway, with almost no change, and the United Kingdom, less than 1/2 of 1 percent per year.

The most striking feature of the long-term growth trends are the rates at which the Asian economies, particularly the newly industrializing economies, have grown. Over the three-decade period beginning in 1960, Japanese output grew 8 percent per year. This was almost 3 percent per year faster than Italy and twice or more the average rates of gain recorded by any of the other countries. However, Japan experienced a substantial slowdown in output growth after 1973, from nearly 13 percent per year to 4-1/2 percent per year.

The Bureau's data series for Korea and Taiwan begin in 1970. Therefore, they are only included in the analysis of long-term trends from 1973 forward. In the post-1973 period, Taiwan and, especially, Korea dominate the output growth comparisons. Over the period between 1973 and 1990, Korean output grew 12-1/2 percent per year and Taiwanese output 8-1/2 percent per year. The Taiwanese growth rate was, in turn, nearly double the average rate of growth experienced by Japan.

Table 2 **Annual percent changes in manufacturing productivity, unit labor costs, and related measures, 14 countries or areas, selected periods, 1960–90**

Country or area	Output per hour	Output	Total hours	Employment	Hourly compensation	Unit labor costs		Exchange rate
						National currency	U.S. dollars	
United States								
1960–90	2.9	3.3	0.4	0.4	6.1	3.1	3.1	—
1960–73	3.3	4.8	1.4	1.4	5.1	1.8	1.8	—
1973–90	2.5	2.2	–.3	–.3	6.8	4.2	4.2	—
1973–79	1.4	1.8	.4	.8	9.7	8.2	8.2	—
1979–90	3.1	2.5	–.6	–.8	5.3	2.1	2.1	—
Canada								
1960–90	2.9	3.8	.8	1.0	7.6	4.6	3.9	–.6
1960–73	4.5	6.5	1.9	2.0	6.2	1.6	1.3	–.2
1973–90	1.7	1.7	.1	.3	8.7	6.9	5.9	–.9
1973–79	2.1	2.5	.4	.8	12.0	9.8	6.9	–2.6
1979–90	1.5	1.3	–.1	.0	6.9	5.4	5.4	.0
Japan								
1960–90	6.9	8.0	1.1	1.6	10.6	3.5	6.6	3.1
1960–73	10.2	12.7	2.3	3.3	15.1	4.4	6.7	2.2
1973–90	4.4	4.6	.1	.4	7.3	2.7	6.6	3.7
1973–79	5.0	3.2	–1.8	–1.5	12.8	7.4	11.3	3.7
1979–90	4.1	5.4	1.2	1.4	4.4	.3	4.1	3.8
Korea								
1960–90	—	—	—	—	—	—	—	—
1960–73	—	—	—	—	—	—	—	—
1973–90	—	12.6	—	—	—	12.0	8.3	–3.3
1973–79	—	16.3	—	—	—	20.5	16.7	–3.2
1979–90	—	10.6	—	—	—	7.6	3.9	–3.4
Taiwan								
1960–90	—	—	—	—	—	—	—	—
1960–73	—	—	—	—	—	—	—	—
1973–90	—	8.5	—	—	—	7.3	9.6	2.1
1973–79	—	10.0	—	—	—	11.3	12.4	1.0
1979–90	—	7.7	—	—	—	5.2	8.0	2.7
Belgium								
1960–90	6.0	4.1	–1.8	–1.0	9.7	3.5	4.9	1.3
1960–73	6.9	6.6	–.3	.8	11.0	3.8	5.8	1.9
1973–90	5.4	2.2	–3.0	–2.4	8.8	3.2	4.1	.9
1973–79	6.0	1.3	–4.5	–3.4	14.0	7.5	12.7	4.8
1979–90	5.0	2.7	–2.2	–1.8	6.0	1.0	–.2	–1.2
Denmark								
1960–90	4.0	3.1	–.9	.1	10.5	6.2	6.6	.4
1960–73	6.4	5.3	–1.1	.5	12.2	5.5	6.6	1.0
1973–90	2.2	1.5	–.7	–.3	9.1	6.8	6.6	–.2
1973–79	4.2	1.6	–2.5	–2.0	14.0	9.4	11.9	2.3
1979–90	1.2	1.5	.3	.6	6.6	5.4	3.8	–1.5
France								
1960–90	4.9	3.9	–.9	–.3	10.7	5.6	5.2	–.3
1960–73	6.4	7.2	.8	1.3	10.0	3.4	4.2	.8
1973–90	3.7	1.4	–2.2	–1.5	11.3	7.3	6.0	–1.2
1973–79	4.6	2.6	–1.9	–1.0	16.3	11.2	12.0	.7
1979–90	3.2	.8	–2.3	–1.8	8.6	5.2	2.9	–2.2
Germany								
1960–90	4.0	3.0	–1.0	–.1	8.3	4.1	7.4	3.2
1960–73	5.6	5.0	–.5	.5	10.3	4.4	8.1	3.6
1973–90	2.8	1.4	–1.4	–.6	6.8	3.9	6.9	2.9
1973–79	4.2	1.7	–2.4	–1.5	9.3	5.0	11.6	6.3
1979–90	2.1	1.2	–.9	.0	5.5	3.3	4.5	1.1
Italy								
1960–90	5.3	5.3	–.1	.3	14.2	8.4	6.0	–2.2
1960–73	6.4	7.4	.9	1.7	12.3	5.5	6.0	.5
1973–90	4.5	3.7	–.8	–.7	15.7	10.6	6.0	–4.2
1973–79	5.7	5.6	–.1	1.0	22.5	15.9	9.2	–5.8
1979–90	3.9	2.7	–1.2	–1.6	12.1	7.9	4.4	–3.3

Table continues on page 30

Employment and total hours. Long-term manufacturing employment growth in the United States has been modest, averaging 0.4 percent per year over the 1960 to 1990 period. However, among the foreign countries studied, only two had higher average rates of increase. Japan experienced about a 1-1/2-percent average rate of gain, while Canada's long-term growth rate was 1 percent. Italy nearly matched the U.S. rate of increase, Denmark showed virtually no overall increase, and the remaining seven countries studied had long-term employment declines, ranging from 1/10 of 1 percent per year in Germany to 1 percent per year in Belgium and 1-1/2 percent per year in the United Kingdom.

Only the United Kingdom showed an overall decline in manufacturing employment in the 1960–73 period; however, after 1973, all of the countries experienced either slowdowns or declines. In the United States, employment growth slowed from about 1-1/2 percent per year in the pre-1973 period to less than 1 percent per year between 1973 and 1979. From 1979 to 1990, U.S. employment fell nearly 1 percent per year. Canada and Italy were the only countries besides the United States to show employment gains between 1973 and 1979. In the period 1979 to 1990, Japan experienced substantial employment growth of 1-1/2 percent per year; Danish manufacturing employment rose about 1/2 of 1 percent per year; Canada and Germany showed almost no change; and the other countries experienced declines ranging from 1/2 of 1 percent per year up to about 3 percent per year in the United Kingdom.[7] A number of countries have shown employment growth over the past 2 years. The exceptions are the United States, Canada, the three Scandinavian countries, and the United Kingdom.

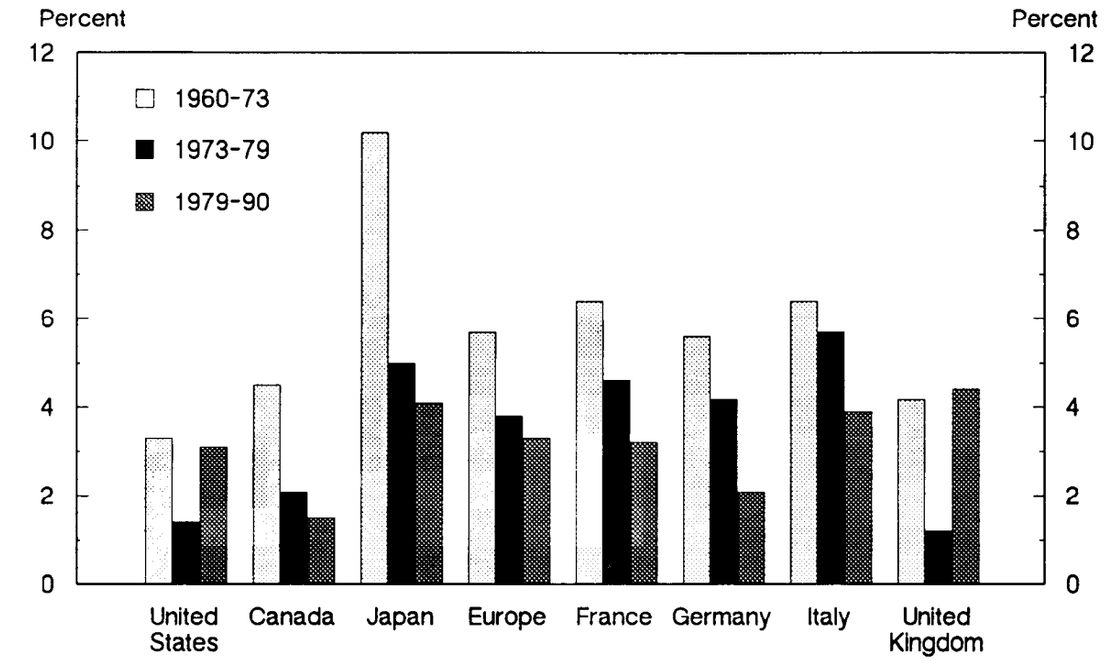
With the exception of the United States, average annual hours worked declined in all countries over the 1960–90 period and in the subperiods of 1960–73 and 1973–79. Consequently, total hours rose less or fell more than employment. Average hours fell in the United States in the 1973–79 period, but showed no change over the 1960–90 time period. In the 1979–90 period, average hours rose, overall, in the United States, Italy, and Sweden, but continued to fall in the other countries. Many of the reductions in average hours, particularly in Europe, were the result of shortening the standard workweek or granting additional paid days of vacation or other paid days off.

Table 2. **Continued—Annual percent changes in manufacturing productivity, unit labor costs, and related measures, 14 countries or areas, selected periods, 1960–90**

Country or area	Output per hour	Output	Total hours	Employment	Hourly compensation	Unit labor costs		Exchange rate
						National currency	U.S. dollars	
Netherlands								
1960–90	5.4	3.8	–1.6	–0.6	9.2	3.6	6.1	2.5
1960–73	7.4	6.0	–1.3	.0	13.0	5.2	7.7	2.4
1973–90	3.9	2.1	–1.8	–1.1	6.4	2.4	5.0	2.5
1973–79	5.5	1.7	–3.6	–2.4	11.6	5.8	11.7	5.6
1979–90	3.1	2.3	–.7	–.5	3.6	.6	1.5	.9
Norway								
1960–90	3.3	2.0	–1.2	–.5	10.4	6.9	7.4	.4
1960–73	4.7	4.7	.0	.9	10.3	5.4	7.2	1.7
1973–90	2.3	.1	–2.2	–1.6	10.5	8.1	7.5	–.5
1973–79	2.1	.2	–1.8	–.6	13.3	11.0	13.3	2.1
1979–90	2.4	.0	–2.3	–2.1	9.1	6.5	4.5	–1.9
Sweden								
1960–90	4.0	2.9	–1.1	–.4	10.6	6.3	5.9	–.5
1960–73	6.4	5.1	–1.2	.1	10.5	3.9	5.3	1.3
1973–90	2.2	1.2	–1.0	–.8	10.7	8.3	6.3	–1.8
1973–79	2.6	.5	–2.0	–.5	14.2	11.3	11.5	.3
1979–90	2.0	1.6	–.5	–.9	8.8	6.6	3.6	–2.9
United Kingdom								
1960–90	3.7	1.5	–2 1	–1.6	11.4	7.5	5.8	–1.5
1960–73	4.2	3.0	–1.1	–.5	9.2	4.8	3.7	–1.0
1973–90	3.3	.4	–2.8	–2.5	13.1	9.5	7.5	–1.9
1973–79	1.2	–.7	–1.9	–1.4	19.4	18.0	15.2	–2.4
1979–90	4.4	1.0	–3.3	–3.0	9.8	5.1	3.5	–1.6

NOTE: Dashes indicate data are not available.

Chart 1. **Average annual percent changes in manufacturing productivity in seven countries and Europe, selected periods, 1960-90**



Hourly compensation costs. Long-term hourly compensation growth in U.S. manufacturing has been moderate relative to such growth in the foreign countries studied. U.S. hourly compensation costs rose an average of 6 percent per year over the three decades from 1960 to 1990. In contrast, average annual hourly compensation increases in the foreign countries ranged from 7-1/2 percent to 14 percent over the period.

When the full three-decade period is broken into subperiods, it can be seen that U.S. hourly compensation costs accelerated dramatically, from an average of 5 percent per year in the pre-1973 period to nearly 10 percent per year between 1973 and 1979, and then dropped back to under 5-1/2 percent per year after 1979.

Increases in hourly compensation costs also accelerated in 8 of the 11 other industrial countries in the 1973–79 period, with most countries showing average annual gains between about 12 percent and 16 percent, but with the United Kingdom reaching more than 19 percent, and Italy more than 22 percent. Japan, Germany, and the Netherlands slowed their compensation increases somewhat, but they still had average increases of more than 9 percent. Like the United States, all of the foreign countries substantially reduced their average compensation increases in the latest subperiod, 1979–90. The United States continued to have one of the lowest average rates of gain, but Germany matched the United States, and Japan and the Netherlands recorded even smaller increases.

Unit labor costs. The long-term trends in manufacturing unit labor costs have been favorable from the perspective of U.S. trade competitiveness. Between 1960 and 1990, U.S. unit labor costs rose at an average rate of about 3 percent per year. This was nearly matched by Japan and the Benelux countries, where unit labor costs rose about 3-1/2 percent per year, followed by Germany at 4 percent. Italy, at 8-1/2 percent, had the most rapid long-term average rate of gain, with the United Kingdom, at 7-1/2 percent, not far behind. Canada had an average increase of 4-1/2 percent and France, 5-1/2 percent; the Scandinavian countries recorded average rates between 6 percent and 7 percent.

After rising at an average rate of less than 2 percent per year from 1960 to 1973, U.S. unit labor costs jumped to more than 8 percent per year between 1973 and 1979 as productivity growth slowed and hourly compensation costs accelerated. However, the post-1979 period has seen average unit labor cost gains in the United

States fall back nearly to the pre-1973 average rate.

Similar patterns can be seen among the foreign economies. All show an increase in the average rate from the 1960–73 period to the 1973–79 period. However, the acceleration is much greater for some economies than for others. The greatest jump occurred in the United Kingdom, where unit labor costs accelerated from an average rate of about 5 percent before 1973 to 18 percent between 1973 and 1979. Germany and the Netherlands, however, experienced increases in average unit labor costs of only about 1/2 of 1 percentage point between the two periods, despite their productivity slowdowns, by reducing somewhat their average gains in hourly compensation costs. The most rapid average rate of increase in the 1973–1979 period was experienced by Korea—20 percent per year.

In the post-1979 period, all of the foreign economies, as well as that of the United States, lowered their average rates of increase in unit labor costs, compared with 1973–79. At 2 percent per year, the U.S. rate was still among the lowest. However, Japan recorded an average rate of increase of only about 1/4 of 1 percent, the Netherlands only about 1/2 of 1 percent, and Belgium 1 percent. The other economies recorded average annual increases between 3 percent and 8 percent, with Germany at the lower end of the range and Korea and Italy at the top.

Unit labor costs in U.S. dollars. Changes in relative currency values also affect the competitiveness of a country's goods in world markets. Therefore, changes in unit labor costs in U.S. dollars (adjusted for exchange rate movements) are a better indicator of changes in competitiveness, and changes in exchange rates have been dramatic since the early 1970's, when the U.S. dollar was devalued twice and exchange rates began to float. Prior to that time, currency exchange rates were generally fixed for extended periods. There were a number of exchange rate changes during the 1960's, however—Germany and the Netherlands revalued their currencies upward in 1961, the value of the Canadian dollar depreciated in the early 1960's, the United Kingdom and Denmark devalued in 1967, and France devalued and Germany revalued in 1969.

As noted above, the United States had the smallest average annual rate of increase in unit labor costs over the entire 1960–90 period—

Chart 2. **Average annual percent changes in manufacturing unit labor costs, six countries and Europe, U.S. dollar basis, selected periods, 1960-90**

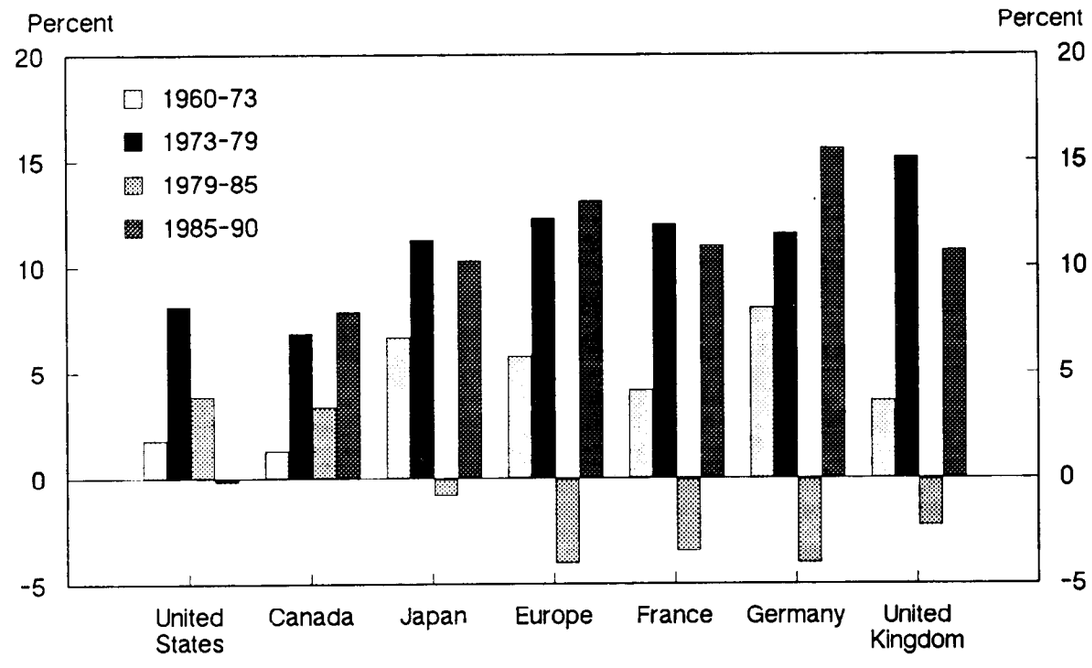


Table 3. **Annual percent changes in manufacturing unit labor costs, 14 countries or areas, selected periods, 1979–90**

Country or area	Unit labor costs		Exchange rate
	National currency basis	U.S. dollar basis	
United States			
1979–90	2.1	2.1	.....
1979–85	3.9	3.9	.....
1985–90	–.1	–.1	.....
Canada			
1979–90	5.4	5.4	.0
1979–85	6.1	3.4	–2.5
1985–90	4.5	7.9	3.2
Japan			
1979–90	.3	4.1	3.8
1979–85	.7	–.8	–1.5
1985–90	–.2	10.3	10.5
Korea			
1979–90	7.6	3.9	–3.4
1979–85	8.2	–1.9	–9.3
1985–90	6.8	11.3	4.2
Taiwan			
1979–90	5.2	8.0	2.7
1979–85	7.1	5.3	–1.7
1985–90	3.0	11.4	8.2
Belgium			
1979–90	1.0	–.2	–1.2
1979–85	1.7	–9.6	–11.1
1985–90	.1	12.3	12.2
Denmark			
1979–90	5.4	3.8	–1.5
1979–85	5.9	–5.8	–11.0
1985–90	4.7	16.6	11.4
France			
1979–90	5.2	2.9	–2.2
1979–85	9.4	–3.4	–11.7
1985–90	.4	11.0	10.5
Germany			
1979–90	3.3	4.5	1.1
1979–85	3.8	–4.0	–7.6
1985–90	2.6	15.6	12.7
Italy			
1979–90	7.9	4.4	–3.3
1979–85	11.1	–3.3	–12.9
1985–90	4.2	14.3	9.8
Netherlands			
1979–90	.6	1.5	.9
1979–85	.6	–7.5	–8.0
1985–90	.5	13.3	12.7
Norway			
1979–90	6.5	4.5	–1.9
1979–85	6.9	–2.1	–8.4
1985–90	6.0	13.0	6.6
Sweden			
1979–90	6.6	3.6	–2.9
1979–85	6.4	–5.3	–11.0
1985–90	7.0	15.2	7.8
United Kingdom			
1979–90	5.1	3.5	–1.6
1979–85	6.2	–2.2	–7.9
1985–90	3.9	10.8	6.6

about 3 percent. The U.S. dollar appreciated relative to some currencies during this period and depreciated relative to other currencies, but, in general, the U.S. advantage was improved by exchange rate changes. The Canadian dollar depreciated, lowering Canada's average annual increase in unit labor costs from about 4-1/2 percent to 4 percent. However, the currencies of Japan, Belgium, Germany, and the Netherlands—the countries with the smallest increases in national currency-based unit labor costs other than the United States—appreciated. Consequently, Japan, Germany, and the Netherlands had average increases, measured in U.S. dollars, of double or more the U.S. rate, and the U.S. differential with Belgium widened. The currencies of Italy and the United Kingdom—the countries with the largest national currency-based increases—depreciated, as did the currencies of France and Sweden. The currencies of Denmark and Norway appreciated somewhat. Measured on a U.S. dollar basis, Canada had the smallest 1960–90 percentage increase in unit labor costs, other than the United States, followed by Belgium and France, while Japan, Denmark, Germany, and Norway had the largest increases.

Within the 1960–90 period, however, there were both up and down movements in the foreign currency values, and in some periods, changes in relative currency values had much larger effects than relative changes in unit labor costs. These changes in currency values varied somewhat by country and timing, but, in general, the relative value of the U.S. dollar was little changed between 1960 and 1971, fell between 1971 and 1973, rose from 1973 to 1976, fell from 1976 to 1980, rose sharply from 1980 to 1985, fell sharply between 1985 and 1988, rose in 1989, and fell again in 1990.

The following analysis uses the same subperiods (1960–73, 1973–79, and 1979–90) as previously discussed, although they do not correspond exactly with the alternating changes in relative currency values.

In the 1960–73 period, the competitiveness of U.S. unit labor costs was improved by exchange rate changes relative to all countries

except Canada and the United Kingdom. Unit labor costs rose less (average percent change) in the United States than in any country except Canada, whether measured in national currency terms or in U.S. dollars. The country most disadvantaged by relative changes in exchange rates was Germany. (See table 2 and chart 2.)

In the 1973–79 period, exchange rate changes improved the competitiveness of U.S. unit labor costs relative to all of the foreign economies except Canada, Korea, Italy, and the United Kingdom. Measured in national currencies, Japan, Belgium, Germany, and the Netherlands had smaller increases in unit labor costs than did the United States. Measured in U.S. dollars, only Canada had a smaller increase. Again, the country most disadvantaged by exchange rate changes was Germany, closely followed by the Netherlands.

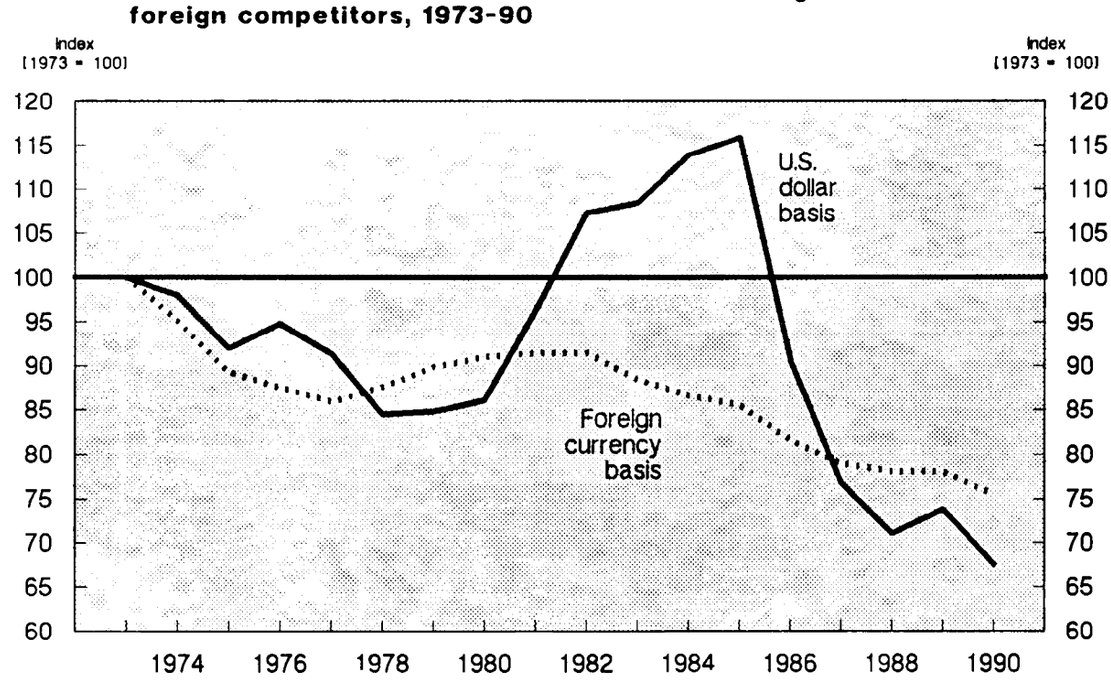
Exchange rate changes improved the U.S. competitive position between 1979 and 1990 relative to Japan, Taiwan, Germany, and the Netherlands, had no effect on U.S.-Canadian relative unit labor costs, but lowered unit labor costs in the other European countries and Korea. Measured in national currencies, Japan and the Netherlands had smaller increases; measured in U.S. dollars, only Belgium and the Netherlands had smaller increases.

In analyzing unit labor costs in U.S. dollars, however, the 1979–90 time period needs to be subdivided. The U.S. dollar rose strongly relative to all the European currencies and to the Korean won between 1979 and 1985, fell sharply relative to the European currencies as well as the Asian currencies between 1985 and 1988, rose in 1989, and then fell even more against the European currencies in 1990—but not against the Asian currencies.

In the 1979–85 period, U.S. unit labor costs rose about 4 percent per year. Measured in national currency terms, unit labor costs rose less in Japan, Belgium, and the Netherlands, rose at the same rate in Germany, and increased 6 percent to 11 percent per year in the other countries. Measured in U.S. dollars, unit labor costs declined in all of the foreign economies except Canada and Taiwan, with the declines ranging from about 1 percent per year in Japan up to nearly 10 percent in Belgium. (See table 3.)

Between 1985 and 1990, U.S. unit labor costs were about unchanged. Unadjusted for exchange rate changes, Japan and Belgium did equally well. Unit labor costs rose only 1/2 of 1 percent

Chart 3. **Indexes of unit labor costs in U.S. manufacturing relative to 13 foreign competitors, 1973-90**



per year in France and the Netherlands; 2-1/2 percent per year in Germany; and 3 percent to 7 percent per year in the other economies. Adjusted for exchange rate changes, the annual average increases were 8 percent in Canada, about 10 percent to 11 percent in Japan, Korea, Taiwan, France, and the United Kingdom, and between 12 percent and 17 percent in the other foreign economies.[8]

Trade-weighted relative measures

The economies covered by these comparative measures differ greatly in their relative importance to U.S. trade in manufactured products. Therefore, the Bureau constructs trade-weighted measures that take account of these differences. The trade weights were derived by rescaling a series for 21 economies that was developed by the International Monetary Fund. The International Money Fund weights are based on disaggregated 1980 trade data for manufactured goods and take account of both bilateral trade and the relative importance of "third country" markets.[9] The following are the rescaled weights (in percent):

Japan	25	Korea	3
Canada	19	Belgium	3
Germany	14	Netherlands	3
United Kingdom	12	Sweden	2
France	8	Denmark	1
Italy	6	Norway	1
Taiwan	4		

Two summary measures are constructed: "competitors" indexes, which are the trade-weighted geometric averages of the unit labor cost indexes for competitor economies, and relative indexes, which are the ratios of the U.S. index to "competitors" indexes. Chart 3 shows the U.S. unit labor cost index relative to all 13 foreign economies on both a national currency and a U.S. dollar basis over the 1973–90 period. Table 4 shows, for selected time periods from 1973, average annual percent changes in U.S. unit labor costs relative to Canada, to Japan, and to the 9 European economies, as well as to all 13 foreign economies.

As table 4 shows, with unit labor costs expressed on a national currency basis for all economies, U.S. unit labor costs fell relative to all 13 competitors combined between 1973 and 1990 and in each of the subperiods, 1973–79, 1979–85, and 1985–90. U.S. unit labor costs also fell relative to Canada and Europe in each of the subperiods. Relative to Japan, however, U.S. unit labor costs rose in the periods 1973–79 and 1979–85 and remained unchanged in the 1985–90 period.

Table 4. **Annual percent changes in U.S. manufacturing unit labor costs relative to competitors, selected periods, 1973–90**

Competitor	Unit labor costs		Exchange rate
	National currency basis	U.S. dollar basis	
Competitors (13)			
1973–90	–1.6	–2.3	–0.6
1973–79	–1.8	–2.7	–1.0
1979–90	–1.6	–2.0	–.5
1979–85	–.8	5.3	6.2
1985–90	–2.5	–10.2	–7.9
Japan			
1973–90	1.4	–2.2	–3.6
1973–79	.8	–2.8	–3.6
1979–90	1.8	–1.9	–3.6
1979–85	3.2	4.7	1.5
1985–90	.1	–9.4	–9.5
Canada			
1973–90	–2.5	–1.7	.9
1973–79	–1.5	1.2	2.7
1979–90	–3.1	–3.2	.0
1979–85	–2.1	.5	2.6
1985–90	–4.4	–7.3	–3.1
European competitors (9)			
1973–90	–2.4	–2.2	.2
1973–79	–2.5	–3.7	–1.3
1979–90	–2.3	–1.3	1.0
1979–85	–2.0	8.2	10.4
1985–90	–2.7	–11.7	–9.2

With unit labor costs measured in U.S. dollars for all economies, U.S. unit labor costs fell relative to Japan in both the 1973–79 and 1985–90 periods, as well as relative to all 13 economies and Europe. The improvement in U.S. manufacturing competitiveness was substantial in the latter period—on an annual average basis, U.S. relative unit labor costs fell 11-1/2 percent against Europe, 9-1/2 percent against Japan, 7-1/2 percent against Canada, and 10 percent against all 13 economies combined. On the other hand, in the 1979–85 period, U.S. unit labor costs rose, on an annual average basis, 8 percent relative to Europe, 4-1/2 percent relative to Japan, 1/2 of 1 percent relative to Canada, and more than 5 percent relative to all 13 economies combined. □

Footnotes

[1] For example, see U.S. Congress, Office of Technology Assessment, *Paying the Bill: Manufacturing and America's Trade Deficit*, June 1988; and Lawrence Mishel, *Manufacturing Numbers: How Inaccurate Statistics Conceal U.S. Industrial Decline* (Economic Policy Institute, 1988). The Bureau of Economic Analysis partially re-

sponded to the criticisms in Frank de Leeuw and Robert P. Parker, "Gross Product by Industry: Comments on Recent Criticisms," *Survey of Current Business*, July 1988, pp. 132–33.

[2] Frank De Leeuw, Michael Mohr, and Robert P. Parker, "Gross Product by Industry, 1977-88: A Progress Report on Improving the Estimates," *Survey of Current Business*, January 1991, pp. 23–37.

[3] The data for Sweden used in this article are from the Swedish national accounts. Since the early 1980's, productivity and unit labor cost measures based on the accounts have diverged substantially from measures constructed directly from a Swedish annual survey of mining and manufacturing industries. See footnote 6.

[4] Manufacturing employment was about unchanged in Korea between 1989 and 1990 and fell 5-1/2 percent in Taiwan, according to their household labor force surveys.

[5] See Arthur Neef and James Thomas, "Trends in manufacturing productivity and labor costs in the U.S. and abroad," *Monthly Labor Review*, December 1987, pp. 25–30.

[6] As noted in footnote 3, Swedish productivity and unit labor cost measures based on the national accounts, the measures used in this article, have diverged since about the early 1980's from measures constructed directly from a Swedish annual industrial survey. The industrial survey is less complete because it relates generally to establishments employing five or more persons and excludes some other manufacturing establishments and a few manufacturing industries. Nevertheless, it shows larger average productivity gains, nearly 2 percent per year between 1985 and 1989, and smaller increases in unit labor costs, about 1 percent per year between 1985 and 1989.

Prior to the 1980's, the two sources tracked quite closely. Statistics Sweden has been engaged in a comprehensive analysis of the discrepancies between the two sources.

[7] Korea's household labor force survey showed manufacturing employment growth rates of 7.8 percent in the 1973–79 period and 4.2 percent in the 1979–90 period, for an overall growth rate of 6.2 percent. Taiwan's household labor force survey showed manufacturing employment growth rates of 6.6 percent and 2.2 percent, for an overall growth rate of 3.7 percent.

[8] See footnote 6 concerning Sweden.

[9] See Anne K. McGuirk, "Measuring Price Competitiveness for Industrial Country Trade in Manufactures," International Monetary Fund Working Paper, April 28, 1986. This paper relates to 17 industrial countries. McGuirk subsequently recalculated the trade weights to include Hong Kong, Korea, Singapore, and Taiwan. The weights given to Korea and Taiwan would be larger based on a more current year.

APPENDIX: Measures of manufacturing productivity and unit labor costs

The Bureau of Labor Statistics constructs trend indexes of manufacturing labor productivity (output per hour), hourly compensation costs, and unit labor costs from three basic aggregative measures—output, total labor hours, and total compensation. The hours and compensation measures refer to all employed persons, including self-employed persons, in the United States and Canada and to all employees (wage and salary earners) in the other economies. Hours refer to hours worked in all countries. The figures for Canada are the official measures prepared by Statistics Canada.

In general, the measures relate to total manufacturing as defined by the International Standard Industrial Classification. However, the measures for France and Italy (beginning 1970) and the United Kingdom (beginning 1971) refer to mining and manufacturing less energy-related products; the measures for Denmark include mining and exclude manufacturing handicrafts from 1960 to 1966; and the measures for the Netherlands exclude petroleum refining and include coal mining from 1969 to 1976.

Output. In general, the output measures are value added in manufacturing (gross product originating), in constant prices from the national accounts of each country. However, output for Japan prior to 1970 and the Netherlands from 1969 to 1977 are indexes of industrial production. The national accounts measures for the United Kingdom are essentially identical to their indexes of industrial production. While methods of deriving national accounts measures differ substantially from country to country, the use of different procedures does not, in itself, connote lack of comparability—rather, it reflects differences among countries in the availability and reliability of underlying data series.

Labor input. The total hours measures are developed from statistics of manufacturing employment and average hours. The series used for France (from 1970 forward), Norway, and Sweden are official series published with the national accounts. Where official total hours series are not available, the measures are developed by BLS using employment figures published with the national accounts, or other comprehensive employment series, and estimates of annual hours worked.

For the Republic of Korea and Taiwan, the Bureau publishes only measures of unit labor costs and its components—output and total compensation. Total hours, and consequently productivity, are not computed for Korea and Taiwan because BLS has not yet developed adequate employment series.

Compensation (labor cost). The compensation measures are from the national accounts, except those for Belgium, which are developed by the Bureau using statistics on employment,

average hours, and hourly compensation. Compensation includes all payments in cash or kind made directly to employees, plus employer expenditures for legally required insurance programs and contractual and private benefit plans. In addition, for some countries, compensation is increased to account for other significant taxes on payroll or employment (or reduced to reflect subsidies). Self-employed workers are included in the U.S. and Canadian figures by assuming that their hourly compensation is equal to the average for wage and salary employees.

Current indicators. For all countries, the measures for recent years may be based on current indicators of manufacturing output (for example, the U.S. output measure for 1990 is based on the trend shown by the Federal Reserve Board's industrial production indexes), employment, average hours, and hourly compensation, until national accounts and other statistics used for the long-term measures become available.

Level comparisons. The BLS measures are limited to trend comparisons. BLS does not prepare level comparisons of manufacturing productivity and unit labor costs, because of data limitations and technical problems in comparing the levels of manufacturing output among countries. Each country measures manufacturing output in its own currency units. To compare outputs among countries, a common unit of measure—such as the U.S. dollar—is needed. Market exchange rates are not suitable as a basis for comparing output levels. What are needed are purchasing power parities (PPP's), that is, the number of foreign currency units required to buy goods and services equivalent to what can be bought with one unit of U.S. currency.

Reasonably reliable PPP's are available for total gross domestic product. However, these were derived from the expenditure side of the national accounts (consumer, business, and government final expenditures for goods and services) and not from the output side of the accounts (gross product originating by industry, or value added). Therefore, the available data are not adequate for constructing industry-specific PPP's. The PPP's for total gross domestic product are also not suitable for component industries, such as manufacturing.